

Change of Control and the Success of China's Share Issue Privatization

Peter L. Rousseau and Sheng Xiao*

June 2007

ABSTRACT

Using two newly available datasets of listed firms covering the period from 1994 to 2003, we test if share-issue privatization, defined here as the change of corporate control from the State to private owners rather than the IPO event as in earlier studies, improved firm performance in China. To illustrate how privatization may have worked, we develop a sequential model of interaction between the government and firm managers in which optimal ownership shares emerge in equilibrium. Our econometric analysis then shows that, in keeping with the model, privatization did improve firm profitability and the productivity of labor.

* Peter L. Rousseau is at the Department of Economics of Vanderbilt University and the National Bureau of Economic Research; Sheng Xiao is at the Department of Economics of Furman University. We thank Christian Ahlin, Junlin Du, Linqiang Huang, Ronald Masulis, Ming Pu, Changwen Zhao, and participants at the 2006 All China Economics International Conference for helpful comments. We also thank Shenzhen GTA Information Technology Co. Ltd. and SinoFin Information Service for technical support. Xiao thanks Vanderbilt University and Furman University for generous financial support.

“China is accelerating the privatization of tens of thousands of state-owned businesses that once served as pillars of Communist Party rule, and has decided to let foreign and private investors buy majority stakes in large enterprises the government had previously refused to sell, according to Chinese officials and researchers.”

--Washington Post, November 12, 2003

Ownership structure is an essential component of economic and political institutions, and by influencing incentives can have a wide impact on the profitability and performance of business enterprises. One important shift in ownership structure occurring at unprecedented speed is the divestiture of shares in enterprises once wholly-owned by governmental units through large-scale privatizations. Since 1979, more than 100 countries, both developed and developing, have implemented privatizations. According to Gibbon (2000, p.1), the cumulative value of proceeds from these transactions surpassed \$1 trillion as early as 1999, and empirical studies for a number of countries already provide strong evidence of positive effects on firm performance (e.g., Megginson et al. 1994; Barberis et al. 1996; Boubakri and Cosset 1998; D’Souza and Megginson 1999; La Porta et al. 1999; Frydman et al. 1999; Gupta 2005).

China, as the world’s largest developing country and indeed its second largest economy based on GDP adjusted for purchasing power parity (PPP), has also joined the global privatization wave with an incremental approach called “share issue privatization.” This involves privatizing state-owned enterprises (SOEs) through the issuance of publicly-traded equity shares.¹ In contrast to the positive evidence for other countries, however, China’s SOEs have *not* in general become more profitable after their initial public offerings (or IPOs), and this makes for

¹ Two methods of privatization have become common over the past 20 years. The former Soviet Union and countries of Eastern Europe have used “voucher privatization,” a method whereby citizens are given or can inexpensively purchase a book of vouchers that represent potential shares in any SOE. This has allowed countries to achieve mass privatization quickly. The second method, adopted by China and several other transition economies, is share-issue privatization. By far the largest fraction of total proceeds raised by privatizing governments has been collected through the latter method.

something of a “profitability puzzle.”²

In light of this, we explore the effectiveness of China’s share-issue privatizations using two newly available datasets for exchange-listed firms and a new definition of the privatization “event.” We conclude that it is a change of control from the State to a private owner, rather than an IPO, that best characterizes “privatization.” Using this definition, we show that Chinese firms *did* become more profitable and more productive after privatization, offering some resolution to the puzzle.

We illustrate how privatization may have affected firm performance in China with a theoretical model that focuses on sequential interactions between the government and the firm. The model shows that a true change of control (rather than just an IPO) is necessary for share-issue privatization to work in countries such as China because firms face high fixed costs of restructuring. While a change of control can lead to a boost in profitability to cover those costs, an IPO may not.

I. Background

Why have so many countries chosen to privatize their SOEs? After all, the Modigliani-Miller theory maintains that firm performance is invariant to the nature of ownership in a world with perfect competition, complete contracts, low information costs, no taxes, and no externalities. Even in the presence of externalities when perfect competition no longer holds, SOEs can still emerge as organizations capable of preventing market failures through pricing policies that take account of social costs (see Shapiro and Willig 1990). Despite the potential advantages, however, SOEs typically suffer from low operational efficiency, and the privatization literature usually points to the incompleteness of contracts and increasing

² See Sun and Tong (2003), Wei et al. (2003), and Wang et al. (2004).

information costs, which become more serious as economies grow complex and their firms more interdependent, as potential sources. This has led to the “agency view” of inefficiency. Two perspectives within this view are:

(1) The “managerial view,” which proposes that SOE managers are inadequately monitored and therefore have only weak incentives for improving operational efficiency (Vickers and Yarrow 1988). Laffont and Tirole (1993) argue that this occurs in SOEs because there is neither an individual owner with a strong incentive to monitor nor a public share price to provide information about how the market judges the manager’s actions. Further, inefficient but non-traded public sector firms lie outside of the market for takeovers;

(2) The “political view,” which asserts that political interference in SOEs leads to operational constraints and distorted objectives. For example, managers may gain political support by pursuing full employment policies at the expense of profits, and may apply soft budget constraints that end up not binding due to bailouts of the State (Kornai 1979).³ These distortions can result in redundant employees (Shleifer and Vishny 1994, Boycko et al. 1996), employment of politically connected individuals rather than the best-qualified (Krueger 1990), poor choices of product and location, and investment in projects with low net present values.

Agency-related factors seem to have motivated China’s economic reforms since 1978. SOEs were at the core of these reforms because they have traditionally been such an important component of the economy and because weak management incentives and heavy policy burdens had long been suspected as a source of inefficiencies therein.⁴

³ Berglof and Roland (1998) and Frydman et al. (1999) show that soft budget constraints are a important source of inefficiency in SOEs, and Lin (1999) shows that they are prevalent in China. Bai and Wang (1999) demonstrate that soft budget constraints result in poor resource allocation decisions.

⁴ For example, Lin et al. (1998) show that even after 18 years of reform, SOEs still employed

In the 1980s, and against a background of global privatization, China did not carry out many privatizations. Instead, it consolidated enterprise property rights at the municipal government level and adopted a governance structure that stressed incentives and enterprise autonomy (Li 1997). Specifically, China's SOE reforms from 1978 to 1992 proceeded in three stages. In the first stage (1979-1983), China implemented a policy of administrative decentralization and profit retention with an eye to improving management incentives. The second stage (1984-87) saw an end to direct funding of SOEs by the government, and an expectation that SOEs would undertake expansions or other improvements via bank loans. Though it seems that the government did this to discipline SOEs by hardening their budgets, the plan was unsuccessful, mainly because the lending banks were also state-owned and thus had only weak incentives to monitor firms. At the same time, SOEs could still get "policy loans" from state banks at preferential interest rates so that budget constraints remained soft.

In the final stage (1988-92), reform focused on the separation of government ownership from control of SOE operations through a "contract responsibility system" that improved incentives for managers to maximize profits. Groves et al. (1995) show that the compensation of a manager in China was generally correlated with both firm profits and sales overall, but that after the implementation of a reform contract the correlation between compensation and profits increased while the correlation between compensation and sales fell. This evidence suggests that the contract system shifted the primary performance objective from sales, the usual objective in a planned economy, to profits, the usual objective in a market economy. Because SOEs were still not fully responsible for their losses, however, soft budget constraints persisted.

57.4 percent of all urban workers and accounted for 52.2 percent of total investment in industrial fixed assets in 1996. They also argue that China's SOEs assume too many functions aimed at improving social welfare rather than enhancing firm performance. See also Mi and Wang (2000) on problems of incentives for management.

Thus, from the beginning of China's reforms, there have been two effects at play in determining performance outcomes. The first is a "convergence-of-interests effect" such that as SOE managers gain more autonomy, their interests become better aligned with those of firm owners (e.g., profit retention), thereby mitigating problems associated with the managerial view. The second "political-intervention effect" is more difficult to eradicate because the State, as the ultimate owner of SOEs, remains responsible not only for their performance (e.g., profitability and productivity), but also for the fulfillment of various social-welfare functions (e.g., the provision of pensions, housing, medical care, high employment, etc.) that tend to worsen performance. As a result, even if reforms are fully implemented, a negative political-intervention effect can remain so long as ownership does not change.

In the 1980s, it seemed that the convergence-of-interests effect was dominant. For example, Li (1997) shows that there were marked improvements in TFP and the marginal productivities of individual factors in a panel of 272 Chinese SOEs between 1980 and 1989. However, the political effect seemed to strengthen in the 1990s. Indeed, Holz (2003, p. vii) shows that in 1990 industrial SOEs suffered aggregate losses in only 3 of 30 major industrial sectors, yet by 1997 there were aggregate losses in 25 of 39 major sectors. A briefing from the National Center for Policy Analysis (1997) reported that about half of China's 118,000 SOEs had losses in 1996, a figure up from one-third in 1995. Public-sector industries also consumed some 75 percent of domestic credit, and at least 20 percent of bank loans were non-performing. It was against this background that the government began to consider privatization seriously as a way to improve the performances of SOEs.

China established two stock exchanges in 1990 and 1991, and their growth has been rapid ever since, with the number of listed firms rising from 345 in 1995 to 1,379 by 2005. Over the

same period, market capitalization rose from 5.7 percent of GDP in 1995 to a peak of 48.5 percent in 2000 before falling back to 17.7 percent in 2005, while trading volume increased more than 10-fold (Rousseau and Xiao 2007). These developments greatly facilitated share issue privatizations.⁵ Jefferson et al. (2003), using a panel of 22,000 Chinese large- and medium-size enterprises from 1994 to 1999, shows a “rapidly diversifying ownership structure in which the role of the state is steadily retreating” (p. 89).

II. Has China’s Share Issue Privation Been Effective?

Has China’s share issue privatizations improved economic performance among the affected firms? It seems so at the aggregate level. Holz (2003) notes that the number of industrial sectors in which SOEs were running aggregate losses was down from twenty-five in 1997 to only four in 2001. At the firm level, however, the findings are mixed. Wei et al. (2003), Sun and Tong (2003), and Wang et al. (2004) find some evidence of higher productivity among recently privatized firms, but do not find significant changes in profitability after an IPO, and in many cases even find significant *decreases* in profitability.

We attribute these results to use of the IPO as the “privatization” date, and propose that the key event in generating a performance turnaround in China has rather been a change in control from the State to private owners. This is because negative political effects may still inhibit performance after an IPO even if some convergence of interests has reduced part of the inefficiency. For example, if an SOE reduces its proportion of State shares from 100 percent to

⁵ China did not claim that privatization was a goal during the initial phases of its stock market development. In 1993, the Communist Party approved the creation of a “modern enterprise system” with the modern limited-liability corporation at its core. When China later implemented de facto share issue privatization it was without official recognition until ex-President Jiang Zemin announced in 1997 the policy of significant ownership diversification of the state sector through complete or partial divestiture of small and medium-sized SOEs.

90 percent in the course of an IPO, the State remains the largest shareholder and the negative political-intervention effects may still operate. Stock market investors can play a monitoring role to some degree at this point, but there will probably not be a true regime change without a change of control.

Shleifer and Vishny (1994, p. 998) study a Nash-bargaining model between politicians and firm managers, and show that (1) “as long as politicians maintain control over firms through direct public control or regulation, privatizing cash flows reduces efficiency and increases corruption,” and (2) “managerial control leads to more efficient resource allocation than political control.” Barberis et al.’s (1996) study of 452 privatized Russian shops shows that “the presence of new owners and new managers raises the likelihood of restructuring”(p. 764). This intuition is confirmed by Frydman et al. (1999) for a set of Central European transition economies. Yet for China from 1994 to 1998, Sun and Tong (2003) admit that “there is not much change in corporate governance in China because the government is still the largest shareholder and in effective control of the privatized firms” (p. 210). Interestingly, Figure 1 illustrates that the vast majority of privatizations that included a change of control occurred after 1998.

Figure 1 here

Based on the above, we hypothesize that profitability improvements should occur for those firms that have actually undergone a transfer of control. Among all listed firms from 1994 to 2002, 116 SOEs shifted control from the State to non-state legal entities or individuals. Figure 2 shows that, in more than 60 percent of cases, the private owner controlled between 20 and 30 percent of total shares when, by our measure, it gained control, and that less than 15 percent of the cases involved ownership shares of less than 20 percent.

Figure 2 here

III. A Model of the Privatization Process

We model privatization in China as a two-period Stackelberg game between the government and the firm. In the first period, the government chooses its optimal fraction of ownership, seeking to maximize a weighted average of an employment objective and a revenue objective. Specifically, the government's policymaker maximizes utility of the form:

$$\max_a U_g(R, L) = (t + a)[AK^\alpha L^\beta - wL - (r - g(a))K] + cL - g(a)K, \quad (1)$$

where R is government revenue, L is employment, a is the ownership share with $0 \leq a \leq 1$, α and β are the respective shares of capital and labor with $\alpha, \beta > 0$, A is a productivity parameter that reflects aggregate and firm-specific shocks, w is the wage, r is the market rate of interest, t is the tax rate on profits, and $c \geq 0$ is the weight given to the employment objective. The cost of government intervention is $g(a)K$, where $g(a)$ is the government's subsidy rate on capital with $g'(a) > 0$. As owner of the fraction a of the firm, the government also holds a claim on this share of the profits. Assuming $w = r = 1$, no taxes, and that the government pays exactly the fraction a of the capital cost, meaning that $g(a) = ar$, the maximization problem in (1) simplifies to:⁶

$$\max_a U_g(R, L) = a[AK^\alpha L^\beta - L - (1 - a)K] + cL - aK. \quad (2)$$

In the second period, the firm's manager maximizes a weighted average of the profit and employment objectives given the ownership share chosen by the government. This dual objective is consistent with earlier characterizations of the privatization process.⁷ Specifically, the firm

⁶ We consider the assumption of no taxes to be reasonable because the tax rate on profits in China is the same for SOEs and private firms, even though the (additional) profit extraction rate is positive for the former and zero for the latter.

⁷ For example, Dong and Putterman (2003, p. 110) state that "governments, especially in

chooses capital and labor to maximize:

$$\max_{K,L} U_f(\pi, L) = (1-t-a)[AK^\alpha L^\beta - wL - (r-g(a))K] + b(a)L. \quad (3)$$

where π is net profit and $b(a)$ is the firm manager's weight on the employment objective. This weight is expressed as a function of a because the more the government owns the firm and controls its operations, the more the manager serves as an agent of the government rather than as a profit-maximizing businessman and places higher weight on employment. To get a closed-form solution, we assume the functional form $b(a) = na$, where $n > 0$ is the "employment preference multiplier." Assuming again that $w = r = 1$ and no taxes, the manager's maximization problem reduces to:

$$\max_{K,L} U_f(\pi, L) = (1-a)[AK^\alpha L^\beta - L - (1-a)K] + naL. \quad (4)$$

Next, we introduce a one-time, upfront fixed cost of an SOE restructuring, denoted by q , and define steady streams of annual profits before and after restructuring as π_0 and π_1 , respectively. The condition for a successful restructuring program is:

$$\frac{\pi_1}{r} > \frac{\pi_0}{r} + q. \quad (5)$$

The above setup illustrates the practice of extracting profit while also providing subsidies. In particular, the model contains the following features:

(1) *The sequential setup reflects the state-dominance of the Chinese economy.* The

government explicitly sets the profit extraction rate and the interest rate charged by State-owned

transition economies, often use SOEs to pursue non-financial objectives and to finance the resulting social burdens with subsidies and policy loans." Bai et al. (2000, p. 716) note that "during transition, maintaining employment and providing a social safety net to the unemployed are important to social stability," and that "because independent institutions for social safety are lacking and firms with strong profit incentives have little incentive to promote social stability due to its public-good nature, SOEs are needed to continue their role in providing social welfare."

banks, and implicitly sets the relative weights on the profit (“efficiency”) and employment (“social stability”) objectives. In practice these weights vary over time to reflect the government’s changing policy concerns.

(2) *Profit extraction is a defining feature of the SOEs.* Dong and Putterman (2003, p. 112) observe that SOEs produced about 44 percent of GDP in 1995 while contributing 71 percent of national fiscal revenue. This implies that SOEs face higher effective tax rates than private firms.

(3) *The preferential interest rate $(r-g(a))$ for SOEs in China is widely recognized.* All major banks in China are state-owned, and the government instructs these banks to lend to SOEs at preferential interest rates. Cull and Xu (2003) observe that such “policy lending” has remained a defining characteristic of the Chinese financial system and that the responsibility to bail out poorly performing SOEs has been assumed increasingly by banks.

(4) *The employment objective $b(a)L$ of the firm manager is consistent with empirical evidence.* Chang and Wong (2004) show that, in a sample of 483 firms listed on the Shanghai Stock Exchange at the end of 1999, about 56 percent still maintain formal ties with local governments and ministries, and that managers’ decision making has been subject to the control of local party committees since the early 1950s. The government seeks to preserve social stability with a low unemployment rate, so the more the government owns a firm (i.e., a is higher), the more weight the manager places on the employment objective (i.e., $b(a)$ is higher).

(5) *The fixed cost of firm restructuring, q , is not negligible.* For example, Imai (2006) reports that, even for just one SOE (the China Petroleum and Chemical Corporation), the cost of restructuring of labor, asset and debt is estimated to be about \$5 billion USD.

The model generates the following predictions, which are proven in the Appendix:

PROPOSITION 1: *The condition for a successful restructuring program is that government ownership must fall dramatically.*

PROPOSITION 2: *The labor productivity of the firm, as measured by sales per employee (P_1), is negatively affected by government ownership: $\frac{\partial P_1}{\partial a} = \frac{1}{\beta} \cdot \frac{-n}{(1-a)^2} < 0$.*

PROPOSITION 3: *The labor productivity of the firm, as measured by profits per employee (P_2), is negatively affected by government ownership: $\frac{\partial P_2}{\partial a} = \left(\frac{1-\alpha}{\beta}\right) \cdot \frac{-n}{(1-a)^2} < 0$.*

Propositions 1-3 illustrate the potential inefficiencies of policy lending. Specifically, the higher the government's ownership share, the more preferential the interest rate (i.e., $g(a)$ is higher and $r-g(a)$ is lower), but the less profitable and productive the firms. Indeed, a 2003 Ernst & Young report states that "in 2002, the non-performing loans of Chinese banks amounted to a staggering \$500 billion USD, a result of over 40 years of extensive policy lending" (p.4). We also show that

PROPOSITION 4: *The profitability of the firm, as measured by return on sales (ROS), is negatively affected by government ownership: $\frac{\partial ROS}{\partial a} = \frac{-n\beta}{[1-(n+1)a]^2} < 0$.*

Propositions 2, 3, and 4 lead directly to the following lemma:

LEMMA 1: *A change of control of the firm from the government to a private owner increases firm profitability and labor productivity.*

These results are driven by the employment objective in the firm manager's utility function, a defining feature of firms with mixed-ownership in China and other transition economies. As propositions 2, 3, and 4 show, profitability and labor productivity are unaffected by government ownership if $n = 0$. As long as $n > 0$, however, we also have:

PROPOSITION 5: For any given government ownership, employment rises in n , while profitability and labor productivity fall.

In other words, for a given share of government ownership, the more weight the firm manager places on employment, the more redundant workers are kept on the job and the lower are profitability and labor productivity. Excess labor is widely recognized as a persistent problem of inefficient SOEs.⁸

PROPOSITION 6: The optimal degree of government ownership falls when the share of capital

in the production function (α) rises: $\frac{\partial \alpha^}{\partial \alpha} = \frac{-2n\beta}{[(2\alpha - 1)(n + 1) + \beta]^2} < 0$.*

Proposition 6 shows that as the capital share in the production function increases, the cost of government ownership or political intervention in the form of a capital subsidy ultimately exceeds the benefit (i.e., profit extraction), so that the government reduces its ownership.

According to the National Statistics Bureau (2005), from 1994 to 2003, the contribution of industry to China's GDP rose from 47.9 percent to 52.2 percent, while the share of agriculture fell from 20.2 to 14.4 percent. This change led to a rise in the capital share because industry is

⁸ See, for example, Shleifer and Vishny (1994). A 2000 OECD report on China also estimates that, "surplus workers in SOEs amounted to at least 20 million, and perhaps as many as 35 million, at the end of 1996. These figures represent between one-fifth and one-third of the total SOE workforce, and between 10% and 17% of total urban employment. Nearly all SOE industry segments have substantial amounts of excess workers." (p. 37)

much more capital-intensive than agriculture, especially for China. Therefore, Proposition 6 suggests that it would be optimal for the government to reduce its ownership and accelerate privatization. Figure 1 shows that it did. Proposition 6 also suggests that it may be optimal for the government to reduce ownership in capital-intensive firms, and once again it seems that such a strategy has been followed. For example, Figure 3 shows that the highest proportion of firms privatized by the end of 2002 were in the more capital-intensive manufacturing industries.

Figure 3 here

IV. Empirics

To test the hypothesis that a change of control marks the transition to higher levels of performance after a privatization, we analyze the China Stock Market and Accounting Research (CSMAR) Database developed by Shenzhen GTA Information Technology Co. Ltd. This source includes financial statements and information about the ownership structures of all exchange-listed firms in China since 1992. We identify changes of control using the *Private Listed Companies Database* developed by the SinoFin Information Service of the China Center for Economic Research at Peking University.

A) Descriptive Statistics

We begin by benchmarking the mean and median profitability, leverage (i.e., ratio of debt to assets), and productivity three years before and three years after a change of control against those for all exchange-listed firms in China from 1994 to 2002.⁹ The measures of profitability are

⁹ We benchmark by computing the means and medians of our measures for all listed firms, and then subtracting these aggregates from the data for individual firms. When building averages and medians we exclude the year in which control changes from both the pre- and post-privatization periods. For listed firms with fewer than three years of data before or after the change of control,

the returns on assets (ROA), equity (ROE), and sales (ROS), where these are ratios of earnings (before interest and taxes) to a firm's assets, book capitalization, and total sales, respectively. Sales and profits per employee (in millions of constant 1998 RMB) are our measures of productivity. We also consider the average number of employees per firm before and after a change of control as a possible source of productivity changes. Our sample of 116 firms that changed control is considerably larger than most used in the privatization literature generally, and is to our knowledge the largest used to date for China.

Panel A of Table I shows that the ROA, ROE, and ROS of privatizing firms increase on average relative to all listed firms, and that two of these differences are statistically significant at the 1 percent level. The mean leverage ratio is also higher after the change, suggesting that private control could lead to greater debt capacities and/or lower costs of capital. Panel B reveals similar patterns for the medians of the sample distributions.

Since the CSMAR database includes employment data starting from 1998 only, our sample is limited to 102 firms that changed control when comparing productivity and employment. Panel C of Table 1 shows the means before and after the change, along with the significance levels of t-tests for their differences. The increase in labor productivity is impressive. Mean sales and profits per employee (benchmarked against all listed firms) turn from negative to positive, which suggests that the change of control is indeed a turning point. At the same time, newly-privatized firms appear to cut back on employees as our model suggests. The Wilcoxon tests for medians in Panel D lend further support to our view that labor productivity improves while employment falls after a change of control from the government to the private sector.

Table I here

we average over the number of years for which data are available. This type of “unbalanced window” is common in studies of privatization (e.g., Dewenter and Malatesta 2001; Gupta 2005).

B) Multivariate Findings

In this section we take a multivariate approach to considering other factors that are likely to affect profitability and productivity in addition to a change of control, including firm size and overall economic conditions. To do this, we estimate regressions of the form

$$ROA_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}, \quad (6)$$

where *POST* is a dummy variable set to unity if the SOE has changed control and zero otherwise, *size* captures the potential for scale economies and is measured by the log of a firm's real assets (in 1998 RMB), *leverage* is the ratio of debt to assets, and the log of per capita *GDP* (in 1998 RMB) controls for the aggregate business cycle.¹⁰ We lag the *leverage* variable one period to mitigate the effects that a firm's performance may have on its own capital structure.

The left panel of Table II contains the regression estimates. The post-privatization dummy, *POST*, has the expected positive effect on profitability in specifications with both random and firm fixed effects and is statistically significant at the one percent level. These regressions offer evidence that a change of control is a pivotal and performance-enhancing event.¹¹ The center panel of Table II reports results for the same regression, except that the return on sales (ROS) is now the dependent variable. The coefficients on the *POST* variable are even larger than those obtained with ROA as the dependent variable, but the findings are qualitatively the same. In the right panel of Table II we consider profits per employee as the dependent variable, and this measure is also higher after a change of control and statistically significant at

¹⁰ Data for GDP are from the 2007 edition of the Economist Intelligence Unit Country Data.

¹¹ GDP is negatively and significantly correlated with ROA. This reflects the upward trend of GDP (rapid economic growth) and the downward trend of ROA (due to increased market competition) over the sample period. The coefficients on *size* are positive, indicating that large firms enjoy higher returns than smaller ones, while negative coefficients on *leverage* suggest that assets in debt-laden firms are generally less productive than others.

the 5 percent level in the fixed effects model.

Overall, the evidence in Table II indicates that, even after controlling for other factors that may affect profitability, firms enjoy returns on assets that are about 3-4 percentage points higher after a change of control, while returns on sales are 9-12 percentage points higher and profits per employee are about 0.08 to 0.16 million RMB higher. Given the small number of firms that experienced a change of control relative to the size of China's stock markets, the potential positive effects of further privatization of SOEs seem too large to overlook.

Table II here

Table III reports results for the same regression specifications as those in Table II, but now we include all exchange-listed firms in China rather than just those that saw a change of control. The findings are in general quite similar to those with the restricted sample, though the sizes of the coefficients on the POST variable are generally smaller. The robustness of the findings in Table II to this broadening of the sample indicates that SOEs that changed control not only performed better after the change, but also outperformed on average a sample of all exchange-listed firms.

Table III here

C) The Endogeneity of the Privatization Decision

If profitable firms are more likely to be privatized than less profitable ones, as Gupta (2005) points out for India, our results would be affected by a selection bias. Jefferson and Su (2006) confirm this intuition for China, showing that the probability of privatization increases with an SOE's profitability. To mitigate the effects of this potential endogeneity of the privatization decision, we re-estimate the multivariate models using a two-stage estimation process. In the first stage, we use a logistic model to obtain fitted values of the POST dummy by

regressing it on two lags each of ROS, the log of sales, and the leverage ratio. In the second stage, the fitted values are used in place of the privatization dummy in regressions that are otherwise the same as those reported in Table III. Because a single logistic regression would involve highly unbalanced data, given that there are now more than 4,000 firm-years in our sample, we estimate the logit model 1,000 times, each time combining all of our post-privatization observations with the same number of “0” observations drawn randomly from firms that did not change control or prior to privatization. We then use the median coefficient for each right-hand side variable from the 1,000 logit regressions to generate a single fitted value for each firm-year, and apply these fitted values in the second stage.

Table IV reports results from the second stage for the full sample of exchange-listed firms. Interestingly, controlling for possible endogeneity of the privatization decision delivers even stronger findings than those found in Table III, with the coefficients for the fitted value of the privatization dummy being positive and highly significant in all cases. These coefficients suggest that former State-owned enterprises enjoy returns on assets after a change of control that are 2-4 percentage points higher than other listed firms, while returns on sales are 9-10 percentage points higher and profits per employee are about RMB 0.06-0.1 million higher. The control variables also matter more in this set of results, with firm size positively and significantly related to profitability and productivity in all specifications, and the leverage ratio negatively related to them. The fits of the second-stage regressions, as given by the R^2 statistics, are also higher than those obtained in Table III.¹²

Table IV here

¹² We also used a Probit model for the first stage and obtained qualitatively similar results.

D) Robustness

Because earlier studies have used the IPO as the privatization “event” rather than the change of control emphasized here, we reconstructed the descriptive statistics in Table I using the usual definition. Table V reports the findings, which indicate that averages and medians of our measures of profitability fall after the IPO for China’s listed firms in all but one case. This confirms the findings of Sun and Tong (2003), at the same time underscoring why we believe that the actual change of control is so important.

Table V here

We also experimented with a stronger definition of “change-of-control”, i.e., when the private owner has gained a majority of shares in the firm. The results are qualitatively similar to those in Table I and are available upon request.

V. Conclusion

The fact that, unlike many other countries, China’s SOEs did not become more profitable after their IPOs between 1994 and 2003 presents something of a puzzle. We attribute this to the lack of or delay in a change of control from the State to private owners, and contend that such transfers of control are what really raise profitability and improve productivity.

We illustrate this mechanism with a sequential model between the government and the firm that generates testable predictions about firm profitability and productivity following a change of control. These predictions are confirmed when taken to the data. Specifically, the 116 exchange-listed firms that experienced a change of control from the State to private owners by the end of 2002 enjoyed higher profitability and productivity after the change than before, while employment for these firms was significantly reduced in the post-change years. These findings

turn out to be robust to controlling for other factors that are likely to affect profitability and our attempts to mitigate potential problems of endogeneity in the decision to privatize.

Overall, the results indicate that share issue privatization, as we have defined it, has indeed been effective in China. This suggests that a continuation of policies designed to encourage privatization of SOEs could yield substantial benefits through the efficiency with which China employs its resources, allowing it to reap more fully the benefits of its recent economic reforms.

References

- Bai, Chong-en and Yijiang Wang, 1999, The myth of the East Asian miracle: the macroeconomic implications of soft budgets, *American Economic Review* 89, 432-437.
- Bai, Chong-en, David Li, Zhigang Tao, and Yijiang Wang, 2000, A multitask theory of the state enterprise reform, *Journal of Comparative Economics* 28, 716-738.
- Barberis, Nicholas, Maxim Boycko, Andrei Shleifer and Natalia Tsukanova, 1996, How does privatization work? Evidence from the Russian shops, *Journal of Political Economy* 104: 764-790.
- Berglof, Erik and Gerard Roland, 1998, Soft budget constraints and banking in transition economies, *Journal of Comparative Economics* 26, 18-40.
- Boubakri, Narjess and Jean-Claude Cosset, 1998, The financial and operating performance of newly privatized firms: evidence from developing countries, *Journal of Finance* 53, 1081-1110.
- Boycko, Maxim, Andrei Shleifer, and Robert W. Vishny, 1996, A theory of privatization, *Economic Journal* 106, 309-319.

- Chang, Eric and Sonia Wong, 2004, Political control and performance in China's listed firms, *Journal of Comparative Economics* 32: 617-636.
- China Stock Market and Accounting Research (CSMAR) Database*, 2005 (Shenzhen GTA Information Technology Co. Ltd., Shenzhen, China).
- Cull, Robert and Lixin Xu, 2003, Who gets credit? The behavior of bureaucrats and state banks in allocating credit to Chinese state-owned enterprises, *Journal of Development Economics* 71: 533-559.
- Dewenter, Kathryn L. and Paul H. Malatesta, 2001, State-owned and privately-owned firms: an empirical analysis of profitability, leverage, and labor intensity, *American Economic Review* 91: 320-334.
- Dong, Xiaoyuan and Louis Putterman, 2003, Soft budget constraints, social burdens, and labor redundancy in China's state industry, *Journal of Comparative Economics* 31: 110-133.
- D'Souza, Juliet and William L. Megginson, 1999, The financial and operating performance of privatized firms during the 1990s, *Journal of Finance* 54: 1397-1435.
- Economist Intelligence Unit Country Data, 2007. <https://eiu.bvdep.com.proxy.library.vanderbilt.edu/version-2007316/cgi/template.dll>.
- Ernst & Young, 2003, Annual Review: Non-performing Loans in China, ([http://www.ey.com/global/download.nsf/China_E/NPL_Report_2003Oct14/\\$file/China%20NPL%20Report%202003%20-%20FINAL.pdf](http://www.ey.com/global/download.nsf/China_E/NPL_Report_2003Oct14/$file/China%20NPL%20Report%202003%20-%20FINAL.pdf)).
- Frydman, Roman, Cheryl Gray, Marek Hessel and Andrzej Rapaczynski, 1999, When does privatization work? The impact of private ownership on corporate performance in the transition economies, *Quarterly Journal of Economics* 114: 1153-1191.
- Gibbon, Henry, 2000, *Privatisation Yearbook* (Thompson Financial, London).

- Groves, Theodore, Yongmiao Hong, John McMillan and Barry Naughton, 1995, China's evolving managerial labor market, *Journal of Political Economy* 103: 873-892.
- Gupta, Nandini, 2005, Partial privatization and firm performance, *Journal of Finance* 60: 987-1014.
- Holz, Carsten A., 2003, *China's Industrial State-owned Enterprises: Between Profitability and Bankruptcy* (World Scientific Press, Singapore).
- Imai, Kenichi, 2006, Explaining the persistence of state-ownership in China, Discussion Paper, Institute of Developing Economies.
- Jefferson, Gary, Albert G. Z. Hu, Xiaojing Guan and Xiaoyun Yu, 2003, Ownership, performance, and innovation in China's large- and medium-size industrial enterprise sector, *China Economic Review* 14: 89-113.
- Jefferson, Gary and Jian Su, 2006, Privatization and restructuring in China: evidence from shareholding ownership, 1995-2001, *Journal of Comparative Economics* 34: 146-166.
- Kornai, Janos, 1979, Resource-constrained vs. demand-constrained systems, *Econometrica* 47: 801-820.
- Krueger, Anne O., 1990, Government failures in development, *Journal of Economic Perspectives* 4: 9-23.
- La Porta, Rafael and Florencio Lopez-de-Silanes, 1999, The benefits of privatization: evidence from Mexico, *Quarterly Journal of Economics* 114:1193-1242.
- Laffont, Jean-Jacques and Jean Tirole, 1993, *A Theory of Incentives in Procurement and Regulation* (MIT Press, Cambridge, MA).
- Li, Wei, 1997, The impact of economic reform on the performance of Chinese state enterprises, *Journal of Political Economy* 105:1080-1106.

- Lin, Justin Yifu, Fang Cai and Zhou Li, 1998, Competition, policy burdens, and state-owned enterprise reform, *American Economic Review* 88: 422-428.
- Lin, Justin Yifu, 1999, Policy burdens, soft budget constraint and state-owned enterprise reform in China, working paper, China Center for Economic Research.
- Meggison, William L., Robert C. Nash, and Matthias van Randenborgh, 1994, The financial and operating performance of newly privatized firms: an international empirical analysis, *Journal of Finance* 49: 403-452.
- Mi, Zhou and Xiaoming Wang, 2000, Agency cost and the crisis of China's SOE, *China Economic Review* 11: 297-317.
- National Center for Policy Analysis, 1997, Selling privatization in China, (<http://www.ncpa.org/pd/dint173.html>).
- National Statistics Bureau. China Statistical Yearbook 2005. <http://www.stats.gov.cn/tjsj/ndsj/>
- Organization for Economic Cooperation and Development, 2000, *Reforming China's Enterprises* (Paris, France).
- Private Listed Companies Database*, 2004 (The SinoFin Information Services, Beijing, China).
- Rousseau, Peter L., and Sheng Xiao, 2007, Banks, stock markets, and China's 'great leap forward', *Emerging Markets Review* 8, forthcoming.
- Shapiro, Carl, and Bob Willig, 1990, Economic rationales for the scope of privatization, in Ezra N. Suleiman and John Waterbury, ed.: *The Political Economy of Public Sector Reform and Privatization* (Westview Press, Boulder, CO).
- Shleifer, Andrei and Robert W. Vishny, 1994, Politicians and firms, *Quarterly Journal of Economics* 109: 995-1025.
- Sun, Qian and Wilson H. S. Tong, 2003, China share issue privatization: the extent of its success,

Journal of Financial Economics 70:183-222.

Vickers, John and George Yarrow, 1988, *Privatization: An Economic Analysis* (MIT Press, Cambridge, MA).

Wang, Xiaozu, Lixin Colin Xu and Tian Zhu, 2004, State-owned enterprises going public: the case of China, *Economics of Transition* 12: 467-488.

Washington Post, 2003, China accelerates privatization, continuing shift from Doctrine, November 12.

Wei, Zuobao, Oscar Varela, Juliet D'Souza, and Kabir M. Hassan, 2003, The financial and operating performance of China's newly privatized firms, *Financial Management* 32: 107-137.

Table I
Performance, Leverage and Employment Before and After a Change of Control

This table reports the mean and median profitability, labor productivity, leverage and employment three years before and three years after a change of control. All measures except employment are benchmarked against the means and medians of all listed firms. If there are fewer years before or after the change, then the available years are used. ***, **, * denote statistical significance for t-tests (for means) or Wilcoxon tests (for medians) at the 1%, 5%, and 10% levels, respectively.

Panel A. *Mean profitability and leverage changes (benchmarked against the mean profitability and leverage of all listed firms)*

Variable	Number of Firms	Mean Before	Mean After	Difference
ROA	116	-0.022	-0.004	0.019***
ROE	116	-0.021	-0.009	0.012
ROS	116	-0.046	0.015	0.061***
Leverage	116	0.038	0.091	0.053***

Panel B. *Median profitability and leverage changes (benchmarked against the median profitability and leverage of all listed firms)*

Variables	Number of Firms	Median Before	Median After	Difference
ROA	116	-0.011	-0.007	0.004
ROE	116	-0.060	-0.047	0.013***
ROS	116	-0.018	0.010	0.028***
Leverage	116	0.033	0.099	0.066***

Panel C. *Mean productivity (in million RMB) and employment changes (benchmarked against the mean productivity of all listed firms)*

Variable	Number of Firms	Mean Before	Mean After	Difference
Sales/Employee	102	-0.198	0.194	0.392*
Profit/Employee	102	-0.075	0.002	0.077**
Employment	102	1804	1693	-111

Panel D. *Median productivity (in million RMB) and employment changes (benchmarked against the median productivity of all listed firms)*

Variables	Number of Firms	Median Before	Median After	Difference
Sales/Employee	102	-0.010	0.020	0.030
Profit/Employee	102	-0.006	0.006	0.012*
Employment	102	1285	696	-589***

Table II
The Impact of Privatization on Firm Profitability and Productivity
(Panel Regression Results for Exchange-Listed Chinese Firms that Changed Control)

The table reports panel regression results on the effects of privatization on firm profitability and productivity:

$$ROA_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}; \quad ROS_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

$$PPE_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

The dependent variables are profitability (return on assets; return on sales) and productivity (profit per employee). The independent variables are: POST (a dummy variable set to unity if the firm has already changed control from the State to private owners), the log of total firm assets in constant 1998 RMB, leverage (i.e., the ratio of debt to assets), and the log of per capita GDP in 1998 RMB. PPE is measured in millions of 1998 RMB. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	ROA		ROS		PPE	
	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects
POST	0.030*** (0.010)	0.040*** (0.012)	0.095*** (0.031)	0.117*** (0.037)	0.075 (0.061)	0.156** (0.094)
log(Assets)	0.007* (0.004)	0.015** (0.007)	0.016 (0.014)	0.061*** (0.023)	0.018 (0.032)	0.154* (0.111)
Leverage	-0.039* (0.021)	-0.040* (0.023)	-0.069 (0.064)	-0.033 (0.072)	0.099 (0.149)	0.039 (0.224)
log(GDP)	-0.138*** (0.028)	-0.186*** (0.032)	-0.323*** (0.087)	-0.507*** (0.101)	0.042 (0.280)	-0.351 (0.409)
R ²	0.040	0.036	0.018	0.010	0.012	0.010
Number of firms	116	116	116	116	99	99
Number of observations	687	687	687	687	344	344

Table III
The Impact of Privatization on Firm Profitability and Productivity
(Panel Regression Results for the Full Sample of all Exchange-Listed Chinese Firms)

The table reports the two-stage-least-squares results on the effects of privatization on firm profitability and productivity:

$$ROA_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}; \quad ROS_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

$$PPE_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

The dependent variables are profitability (return on assets; return on sales) and productivity (profit per employee). The independent variables are POST (a dummy variable set to unity if the firm has already changed control from the State to private owners), the log of total firm assets in constant 1998 RMB, leverage (i.e., the ratio of debt to assets), and the log of per capita GDP in 1998 RMB. PPE is measured in millions of 1998 RMB. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	ROA		ROS		PPE	
	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects
POST	0.007* (0.005)	0.020*** (0.006)	0.039*** (0.014)	0.051*** (0.016)	0.098* (0.070)	0.087 (0.078)
log(Assets)	0.008*** (0.001)	0.002 (0.002)	0.025*** (0.004)	0.029*** (0.007)	0.166*** (0.026)	0.228*** (0.050)
Leverage	-0.024*** (0.007)	-0.010 (0.008)	-0.059*** (0.020)	-0.023 (0.023)	-0.185 (0.116)	-0.158 (0.138)
log(GDP)	-0.101*** (0.005)	-0.122*** (0.006)	-0.229*** (0.015)	-0.289*** (0.017)	-0.014 (0.093)	-0.076 (0.103)
R ²	0.044	0.034	0.022	0.020	0.018	0.018
Number of firms	1201	1201	1201	1201	1180	1180
Number of observations	6810	6810	6810	6810	4066	4066

Table IV
The Impact of Privatization on Firm Profitability and Productivity
(Two-Stage-Least-Squares Results for the Full Sample of all Exchange-Listed Chinese Firms)

The table reports the two-stage results on the effects of privatization on firm profitability and productivity. The first stage logit regression uses the post-privatization dummy on the left hand side and two lags of profitability (Return on Sales), firm size, and leverage on the right. The second stage regressions are

$$ROA_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}; \quad ROS_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

$$PPE_{i,t} = \alpha_i + \alpha_1 POST_{i,t} + \alpha_2 GDP_{i,t} + \alpha_3 leverage_{i,t-1} + \alpha_4 size_{i,t} + \varepsilon_{i,t}$$

where the dependent variables are profitability (return on assets; return on sales) and productivity (profit per employee). The independent variables are POST (the fitted value of POST from the first stage logistic regression), the log of total firm assets in constant 1998 RMB, leverage (i.e., the ratio of debt to assets), and the log of per capita GDP in 1998 RMB. PPE is measured in millions of 1998 RMB. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	ROA		ROS		PPE	
	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects
POST	0.018*** (0.002)	0.039*** (0.003)	0.100*** (0.006)	0.089*** (0.010)	0.095*** (0.032)	0.057* (0.038)
log(Assets)	0.023*** (0.002)	0.023*** (0.004)	0.094*** (0.006)	0.046*** (0.010)	0.242*** (0.034)	0.244*** (0.046)
Leverage	-0.220*** (0.012)	-0.218*** (0.016)	-0.702*** (0.034)	-0.452*** (0.046)	-0.474*** (0.159)	-0.304* (0.173)
log (GDP)	-0.049*** (0.007)	-0.062*** (0.008)	-0.118*** (0.019)	-0.147*** (0.023)	0.072 (0.090)	0.054 (0.096)
R ²	0.124	0.045	0.132	0.069	0.022	0.020
Number of firms	1036	1036	1036	1036	1030	1030
Number of observations	4477	4477	4477	4477	3671	3671

Table V
Comparing Profitability Before and After the IPO
(“Profitability Puzzle” Reconstructed)

The table reports the mean and median profitability of China's exchange-listed firms before and after their IPOs, as well as the differences. The windows used for comparison are three years before and three years after an IPO. If there are fewer than three years before or after the change, then the available years are used. Panel A and B report changes in mean profitability, not benchmarked and benchmarked against all listed firms, respectively. Panels C and D report changes in median profitability, once again not benchmarked and benchmarked against all listed firms. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A. Mean profitability changes (not benchmarked against mean profitability of all listed firms)

Variable	Number of Firms	Mean Before	Mean After	Difference
ROA	116	0.110	0.055	-0.055***
ROE	116	0.253	0.094	-0.159***
ROS	116	0.194	0.147	-0.047***

Panel B. Mean profitability changes (benchmarked against mean profitability of all listed firms)

Variable	Number of Firms	Mean Before	Mean After	Difference
ROA	116	0.035	0.000	-0.035***
ROE	116	0.113	0.034	-0.079***
ROS	116	-0.011	0.077	0.088***

Panel C. Median profitability changes (not benchmarked against median profitability of all listed firms)

Variable	Number of Firms	Median Before	Median After	Difference
ROA	116	0.094	0.060	-0.034***
ROE	116	0.208	0.112	-0.096***
ROS	116	0.156	0.129	-0.027***

Panel D. Median profitability changes (benchmarked against median profitability of all listed firms)

Variable	Number of Firms	Median Before	Median After	Difference
ROA	116	0.029	-0.002	-0.031***
ROE	116	-0.033	-0.055	-0.022***
ROS	116	0.027	-0.002	-0.029***

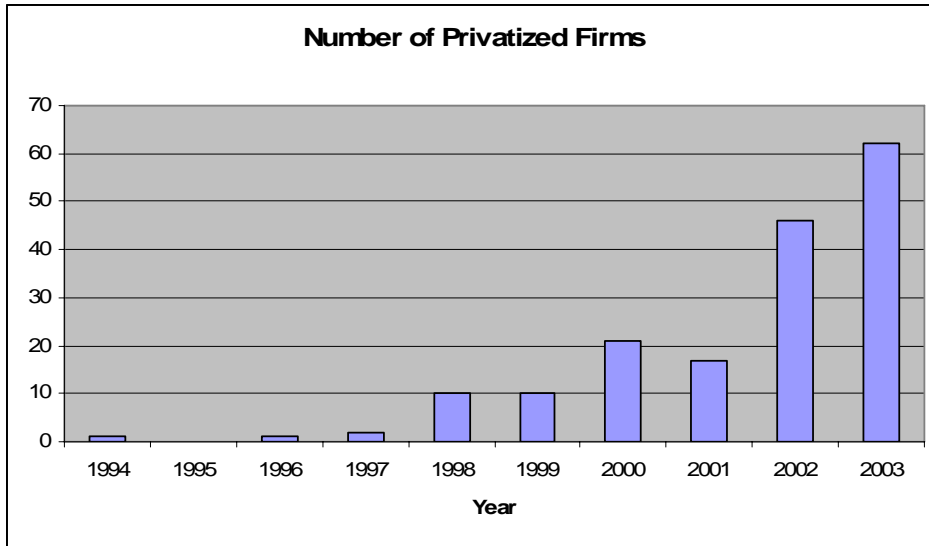


Figure 1: Number of Listed Firms in China with Change-of-Control in Each Year

By the end of 2002, 116 state-owned enterprises had been privatized. By the end of 2003, 178 state-owned enterprises had been privatized.

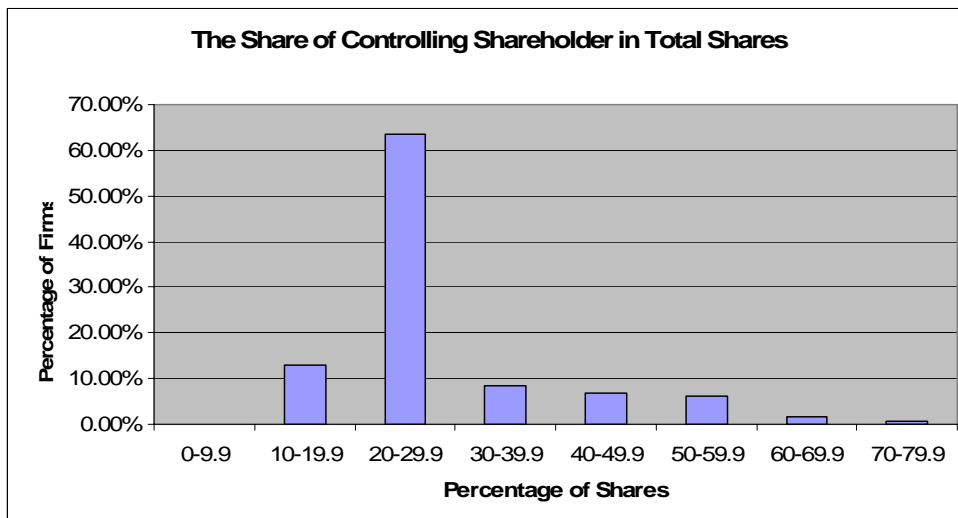


Figure 2: The Share of the Controlling Private Shareholder when the Private Owner Gained Control (1994-2003)

In more than 60 percent of cases, the private owner has acquired between 20 and 30 percent of total shares when, by our measure it, it gains control. Less than 15 percent of the cases involve ownership shares of less than 20 percent.

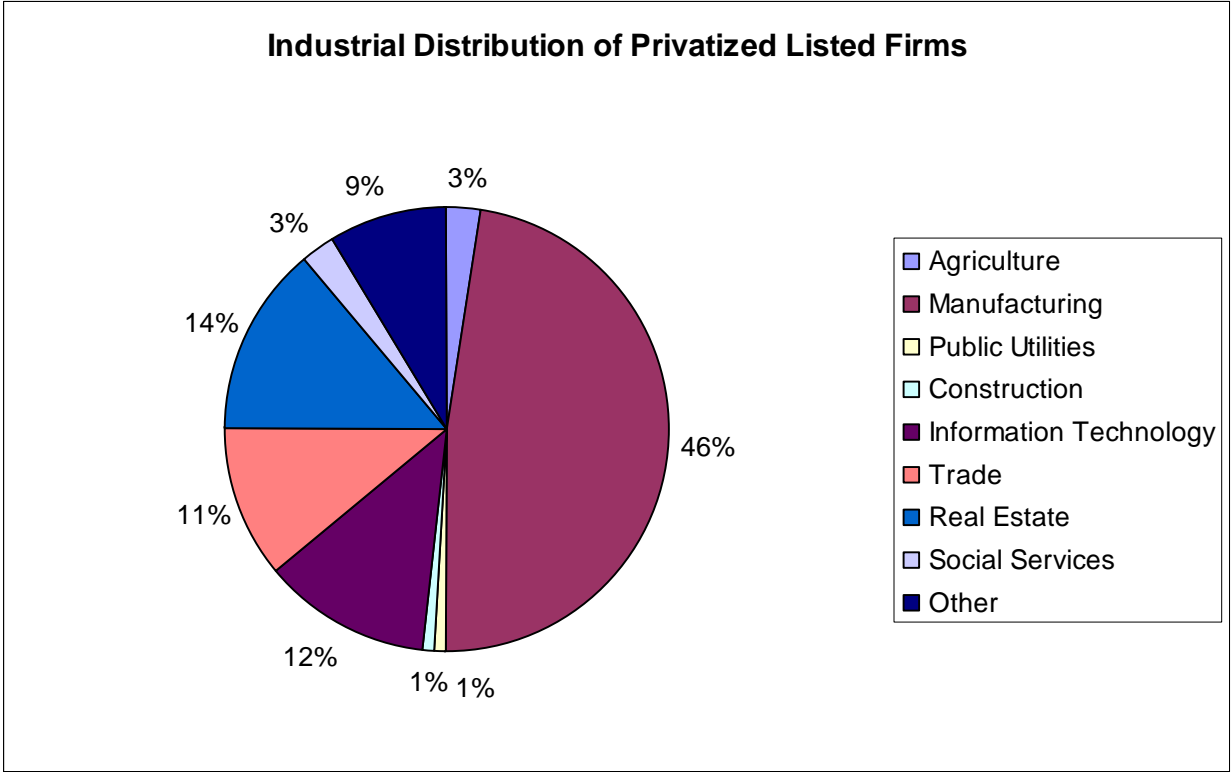


Figure 3: The Industrial Distribution of Privatized Listed Firms

Among the 116 firms that had been privatized by the end of 2002, the highest proportion of firms (46 percent) was in the manufacturing industry.

APPENDIX PROOFS

We present the proofs of propositions 1-6 below.

PROOF OF PROPOSITION 1:

The second-period firm manager's maximization problem:

$$\max_{K,L} (1-a)[AK^\alpha L^\beta - L - (1-a)K] + naL$$

$$\text{Assume : } 1 > a > 0, n > 0, 1 > \alpha + \beta > 0, \alpha > 0, \beta > 0$$

First Order Conditions:

$$K : A\alpha K^{\alpha-1} L^\beta - (1-a) = 0 \Rightarrow A\alpha K^{\alpha-1} L^\beta = 1-a \quad (\text{A1})$$

$$L : (1-a)A\beta K^\alpha L^{\beta-1} - (1-a) + na = 0$$

$$\Rightarrow (1-a)A\beta K^\alpha L^{\beta-1} = 1-(n+1)a \quad (\text{A2})$$

$$(\text{A2})/(\text{A1}) \Rightarrow K/L = \frac{\alpha[1-(n+1)a]}{\beta(1-a)^2} \quad (\text{A3})$$

Profitability=ROS (Return on Sales)

$$\begin{aligned} &= [AK^\alpha L^\beta - L - (1-a)K] / AK^\alpha L^\beta \\ &= 1 - \frac{1}{AK^\alpha L^{\beta-1}} - \frac{1-a}{AK^{\alpha-1} L^\beta} \end{aligned} \quad (\text{A4})$$

Using ROS (Return on Sales) to measure firm profitability (π), and with the proportion of restructuring cost in total sales denoted by q , the condition for a successful privatization is:

$$\frac{\pi_1}{r} > \frac{\pi_0}{r} + q \quad (\text{A5})$$

where π_1 is firm profitability after privatization, π_0 is profitability before privatization, and r is the financial market interest rate.

Plugging (A1), (A2), and (A4) into (A5) we get:

$$\begin{aligned} &\Rightarrow 1 - \alpha - \frac{\beta(1-a_1)}{1-(n+1)a_1} > 1 - \alpha - \frac{\beta(1-a_0)}{1-(n+1)a_0} + qr \\ &\Rightarrow \frac{1-a_0}{1-(n+1)a_0} - \frac{1-a_1}{1-(n+1)a_1} > \frac{qr}{\beta} \end{aligned} \quad (\text{A6})$$

$$\text{Let } f(a) = \frac{1-a}{1-(n+1)a}, \text{ we then have: } f'(a) = \frac{n}{[1-(n+1)a]^2} > 0 \quad (\text{A7})$$

By the mean value theorem, there must exist a value c , where $a_1 < c < a_0$, that satisfies:

$$\begin{aligned} \frac{f(a_0) - f(a_1)}{a_0 - a_1} &= f'(c) \\ \Rightarrow f(a_0) - f(a_1) &= f'(c)(a_0 - a_1) \text{ where } f(a_0) = \frac{1-a_0}{1-(n+1)a_0}, f(a_1) = \frac{1-a_1}{1-(n+1)a_1} \quad (\text{A8}) \end{aligned}$$

By (A6) and (A8), we have:

$$f'(c)(a_0 - a_1) > \frac{qr}{\beta}$$

By (A7), we know $f'(c) > 0$, therefore: $a_0 - a_1 > \frac{qr}{\beta f'(c)}$

$$\Rightarrow a_1 < a_0 - \frac{qr}{\beta f'(c)}, \text{ where } \frac{qr}{\beta f'(c)} > 0$$

This implies that the government ownership must fall below a threshold so that the profit gain can cover the fixed cost of restructuring. A change-of-control can fulfill this condition while an IPO may not.

PROOF OF PROPOSITION 2:

$$\begin{aligned} P_1 = \text{Pr oductivity}_1 &= \text{Sales} / \text{Employee} = AK^\alpha L^\beta / L \\ &= AK^\alpha L^{\beta-1} \quad (\text{A9}) \end{aligned}$$

$$\text{By(A2)and(A9)} \Rightarrow P_1 = \frac{1}{\beta} \bullet \left[\frac{1-(n+1)a}{1-a} \right] \quad (\text{A10})$$

$$\Rightarrow \frac{\partial P_1}{\partial a} = \frac{1}{\beta} \bullet \frac{-n}{(1-a)^2} < 0 \quad (\text{A11})$$

PROOF OF PROPOSITION 3:

$$\begin{aligned} P_2 = \text{Pr oductivity}_2 &= \text{Pr ofit} / \text{Employee} = [AK^\alpha L^\beta - L - (1-a)K] / L \\ &= AK^\alpha L^{\beta-1} - 1 - (1-a)K / L \quad (\text{A12}) \end{aligned}$$

By (A2), (A3) and (A12):

$$P_2 = \left(\frac{1-\alpha}{\beta}\right) \left[\frac{1-(n+1)a}{1-a}\right] - 1 \quad (\text{A13})$$

$$\Rightarrow \frac{\partial P_2}{\partial a} = \left(\frac{1-\alpha}{\beta}\right) \cdot \frac{-n}{(1-a)^2} < 0$$

PROOF OF PROPOSITION 4:

Profitability=ROS (Return on Sales)

$$= [AK^\alpha L^\beta - L - (1-a)K] / AK^\alpha L^\beta$$

$$= 1 - \frac{1}{AK^\alpha L^{\beta-1}} - \frac{1-a}{AK^{\alpha-1} L^\beta} \quad (\text{A14})$$

By (A1), (A2) and (A14):

$$ROS = 1 - \frac{\beta(1-a)}{1-(n+1)a} - \alpha \quad (\text{A15})$$

$$\Rightarrow \frac{\partial ROS}{\partial a} = \frac{-n\beta}{[1-(n+1)a]^2} < 0$$

PROOF OF PROPOSITION 5:

By (A10):

$$P_1 = \frac{1}{\beta} \cdot \left[\frac{1-(n+1)a}{1-a}\right] \Rightarrow \frac{\partial P_1}{\partial n} = \frac{-a}{\beta(1-a)} < 0$$

By (A13):

$$P_2 = \left(\frac{1-\alpha}{\beta}\right) \left[\frac{1-(n+1)a}{1-a}\right] - 1 \Rightarrow \frac{\partial P_2}{\partial n} = -\frac{(1-\alpha)a}{\beta(1-a)} < 0$$

By (A15):

$$ROS = 1 - \frac{\beta(1-a)}{1-(n+1)a} - \alpha \Rightarrow \frac{\partial ROS}{\partial n} = \frac{-(1-a)a\beta}{[1-a(1+n)]^2} < 0$$

By (A3) and (A2), we can solve for the optimal employment size, L^* :

$$L^* = \left\{ \left[\frac{(1-a)A\beta}{1-(n+1)a} \right] \left[\frac{\alpha(1-(n+1)a)}{\beta(1-a)^2} \right]^\alpha \right\}^{\frac{1}{1-\alpha-\beta}}$$

$$\Rightarrow \frac{\partial L^*}{\partial n} = \frac{a(1-\alpha)}{(1-a-an)(1-\alpha-\beta) \left\{ \frac{(1-a)^{2\alpha+1} A\beta^{1-\alpha} \alpha^\alpha}{(1-a-an)^{1-\alpha}} \right\}^{\frac{1}{1-\alpha-\beta}}}$$

Assume P_1 (Sales/Employee) is positive, by (A10), $1-(n+1)a > 0 \Rightarrow 1-a-an > 0$. By

assumption, $1-\alpha-\beta > 0$ and $1-\alpha > 0$, $1 > a > 0$. Therefore, $\frac{\partial L^*}{\partial n} > 0$. The intuition is that when $n=0$, we can get the benchmark optimal employment size for profit maximization. As n increases, employment deviates from that benchmark level, and redundant workers are employed as a result.

PROOF OF PROPOSITION 6:

The first-period government's maximization problem (endogenizing a)

$$\max_a [AK^\alpha L^\beta - L - (1-a)K] + cL - aK$$

FOC (First Order Condition)

$$AK^\alpha L^\beta - L - K + 2aK - K = 0$$

Divide both sides by L:

$$\Rightarrow AK^\alpha L^{\beta-1} - 1 + (2a-2)\frac{K}{L} = 0 \tag{A16}$$

By (A2), (A3) and (A16):

$$\frac{1}{\beta} \left[\frac{1-(n+1)a}{1-a} \right] - \frac{2\alpha[1-(n+1)a]}{\beta(1-a)} - 1 = 0$$

$$\Rightarrow a^* = \frac{2\alpha + \beta - 1}{(2\alpha - 1)(n+1) + \beta}$$

$$\Rightarrow \frac{\partial a^*}{\partial \alpha} = \frac{-2n\beta}{[(2\alpha - 1)(n+1) + \beta]^2} < 0$$

Q.E.D.